

knots an hour. Her engine and fireroom force is comparatively small—fourteen engineers, fifteen oilers, thirty-six firemen, twenty-six coal passers, two storekeepers, two stewards and one winchman making up the three watches.

CASCADES AND COLONNADE OF STATES AT THE EXPOSITION.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Compared with previous expositions, the present grounds at the St. Louis Fair are laid out on a scale of magnificence which renders them certainly the most imposing and beautiful architectural display ever made in an enterprise of this character. The architects took advantage of a dominating hill about 100 feet in height, which slopes gradually to the plain upon which the exhibition palaces are grouped, and placed upon the apex of this hill the leading architectural feature of the whole. The exhibit palaces are laid out on avenues which radiate from this common center, and upon the crest of the hill stands the central architectural building, the great Hall of Festivals, forming a center of a vast gently curving structure known as the Colonnade of States. The latter terminates at either end in circular pavilions, each 140 feet in height and corresponding somewhat in architectural treatment to Festival Hall. The Colonnade itself, which is 52 feet in height and over a quarter of a mile in length, forms a vast arc of a circle along the brow of the hill, crowning the crest of a natural amphitheater that rises 70 feet above the surrounding country.

At intervals along the Colonnade are mammoth allegorical statues, representing the fourteen States included in the Louisiana Purchase. The face of the hillside fronting the Industrial Palaces is laid out as a sloping lawn, which just now is blazing with a wealth of color, due to the wealth of bloom in the flower beds. From the front of the Festival Hall and of each pavilion flanking the Colonnade, there gushes forth the water of three large cascades. The central cascade starts with a width of 50 feet, and gradually broadens out to a width of 152 feet, where it takes its final plunge into the central cascade basin below. The total fall is 95 feet, and the length down the face of the falling water is about 300 feet. All three cascades converge to the central lagoon, and at night time, by the aid of colored electric lighting, a most beautiful and varied effect is produced. From an engineering standpoint the cascades are a truly notable performance, involving as they do the lifting of 90,000 gallons of water every minute to a height of 95 feet, the water circulating in this way from the lagoon to the summit of the cascades and back again. The pumping machinery is located beneath one of the side cascades, and the work is done by three large centrifugal pumps that are operated by induction motors, each of 2,000 horse-power capacity.

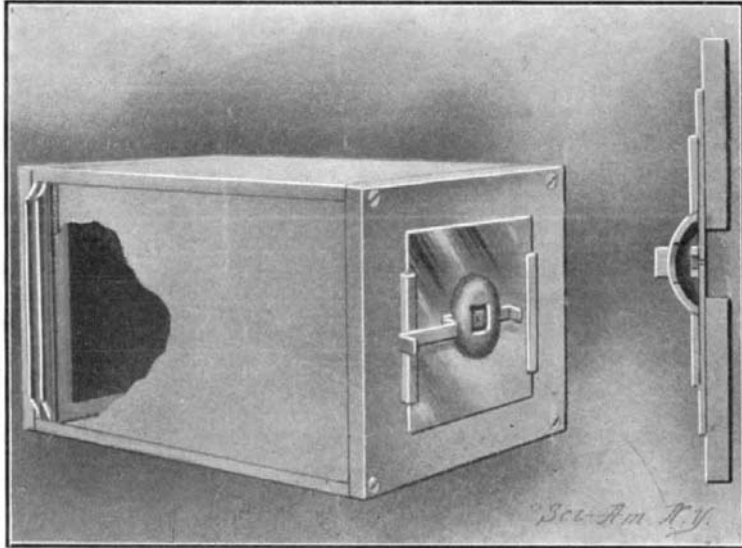
The lagoons from which the water is drawn hold about twenty-five million gallons, and when the pumps are running at the rate of 90,000 gallons a minute, it takes about four and one-half hours to pass the entire water in the lagoon through the pumps. It is evident that such rapid handling of the water necessitated special provisions to prevent a vortex in the lagoon; and to overcome the difficulty, and to promote a general circulation of the water, the suction pipe leading to the pumps is carried some 500 feet down the main lagoon, and is so arranged that water can be drawn at will through screened openings distributed throughout its entire length.

The great Hall of Festivals itself carries a dome 140 feet in diameter that rivals in size that of St. Peter's at Rome. Of course, in height it is considerably smaller than St. Peter's, which extends some 450 feet from the ground level, whereas the height from the grand court to the top of the dome of Festival Hall is about 250 feet. The diameter of the hall at its base is 192 feet, if we exclude the terrace upon which it stands. The whole building covers more than two acres, and it has accommodations for about 4,000 people.

As the building has a strictly festive purpose, the architect and the sculptor have aimed to render it joyous in its spirit and treatment; but above and beyond that, the entire composition of the Cascades, the Colonnade, and Festival Hall has been given an historic as well as an allegorical significance, expressive of the jubilation which a great nation must naturally feel that the sway of liberty was extended by the Louisiana Purchase from the Atlantic to the Pacific. This idea is strongly brought out in the sculptural decorations. Around the central cascades stairways descend on both sides, and swing away in opposite directions to the Basin below. The side cascades represent in their treatment the Spirit of the Atlantic and the Spirit of the Pacific. Each is 400 feet in length, and the scheme includes fifteen groups of sta-

tuary for each side. At the head of each cascade and in front of the pavilions are groups which the sculptor has named respectively "Spirit of the Atlantic" and "Spirit of the Pacific," the Atlantic Ocean being symbolized by the figure of a vigorous youth at whose feet soars an eagle, typifying the restless and turbulent character of the Atlantic, while beneath are groups of children and forms of sea lions. A graceful girl reclining above a sea gull, a grizzled sea god, and other allegorical expressions are scattered throughout the length of this cascade.

The fountain for the opposite cascade is surmounted by a flying female figure with an albatross, and var-



A LENSLESS OR PINHOLE CAMERA.

ious groups of characteristic statuary attend its progress to the lagoon below.

The Colonnade of States, which forms the background of this splendid picture in turf and stone and water, finds its motive in the majestic approach to St. Peter's at Rome, and it is, of course, in some degree reminiscent of the lovely Peristyle at Chicago. Throughout the structure of the Colonnade, square pylons serve to give a dignified and worthy framing to the colossal statuary, which typifies the twelve States and two Territories which have been formed from the original purchase. If the architects and sculptors had done nothing more at the Fair than produce this Festival Hill, with its cascades and lagoon and magnificent reach of landscape garden effects, they might



A PHOTOGRAPH TAKEN WITH THE PINHOLE CAMERA.

well rest satisfied; for it is in itself, independently of the great work to be found embodied in the palaces and their flanking and surrounding statuary, a splendid tribute to the high position which America is winning among the nations of the earth in the field of sculpture and architecture.

The Speed Record of the "Colorado."

On her builders' trial, the United States armored cruiser "Colorado" attained a maximum speed over the measured mile of 22.31 knots an hour. The average of two runs under forced draft was 22.1 knots an hour.

LENSLESS PHOTOGRAPHY.

BY N. R. BRIGGS.

The taking of a photograph, and a good one, too, with a camera without a lens, may seem to many utterly incredulous. Nevertheless, it is done, and this innovation in photography has become an interesting feature with many lovers of the photographic art.

A piece of tinfoil, through which was pierced a fine needle hole, to serve the purpose of a lens in admitting light to the sensitive plate, was secured to the front piece of the camera, in place of a lens, and the exposure made in the regular manner. Pictures thus made are now popularly known as pinhole photographs. The pictures, however, were not wholly satisfactory, owing to the difficulty of getting a perfectly round and smooth hole through this soft, flexible metal, for in this lay the main principle of success. But this has led to the bringing out of a new invention called the "radioscope," which consists of a very thin piece of hammered brass plate, through which is bored an accurately round and smooth hole, and so mounted that it can be quickly adjusted to any camera, or any light-tight box that fancy may dictate.

The accompanying illustration is from a reproduction of a pinhole photograph of a scene in Central Park, taken for the writer by Mr. Charles G. Willoughby, of New York.

As will be observed, there is a lack of that extreme sharpness produced by a regular photographic lens; but, as has been wisely said, this is more than compensated for by a softness of tone equaled only by the brush of an artist.

The interest manifested in this new objective is due to the fact that it is of universal focus—the rays focusing in the stop; the perspective is true, no part of the picture being out of focus, while interior and architectural photographs are rectilinear, that is, without distortion of any kind, for the rays of light fall directly upon the plate without interference of any kind.

Nor is the work of the pinhole objective confined to any one subject, for with it, most pleasing portraits can be made. And it is said that work requiring the sharpest definition, such as copies, reproductions of documents, etc., can be often better done by the pinhole objective than it can with a fine lens. The reason is obvious. A lens focuses often sharper than the eye, giving a staring, unnatural effect to the resulting print.

Another singular feature in connection with the pinhole objective is that any size camera may be used. For instance, it will take a picture upon a plate three inches long or twenty inches long. Therefore, it will be seen that all one has to do is to arrange his camera for a small or large plate, and with the latter, interesting panoramic views could be secured. There is no doubt that a very cheap and satisfactory folding camera, in which to use any of the present series of roll films, could be made for special panoramic work.

Of course, it should be understood that, owing to the small amount of light admitted through a pinhole objective, the time of exposure will naturally be longer than with a lens; and while it is possible to overexpose, there is less liability than with a lens.

Smoke as a Preventive of Frost.

M. Bignon has recently addressed to the French National Society of Agriculture a note giving interesting information on the efficacy of artificial clouds in preventing late frosts. For many years he has successfully practised this. His vineyard thus protected covers about 15 acres and is divided into five parts, separated from east to west by walks 12 to 15 feet wide and circled by an avenue of equal width. These walks facilitate the placing of the fires, which are built in a small basin sunk into the earth and filled with 15 or 20 pounds of resinous matter and some pieces of pine and other vegetable debris. The basins are some 50 feet apart.

In 1903 the frosts were very heavy for a week, and recourse was had four times to artificial fires. The total expense was \$400. The effect is stated as having preserved 25 per cent of the harvest, or some 125 to 150 barrels of wine.

It is stated that any substance can be burnt which gives a thick and abundant smoke, such as green herbs, moss, damp straw, tufts of grass, etc., but best results have been obtained in France by the heavy oils which are the residues of gas.

Every Danish state locomotive that has gone for some years past into the shops for repairs has had its wheel peripheries gaged, and, besides less wear with large wheels, it is found that single drivers run better than four-coupled, and four than six-coupled, where the road is the same, and that, in each class, where the road is more flimsy, the wear is greater.